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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/637,570	08/14/2000	Seiichi Kondo	NIT-215	8469

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ALEXANDRIA, VA 22314

EXAMINER

NGUYEN, HA T

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 05/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/637,570

Applicant(s)

KONDO ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment, Response to the Office Action mailed 11-15, 2002 and Request for a RCE have been entered and made of record (Paper Nos. 15 and 18).

Notes: a clean copy of the claims is also needed.

Response to Amendment

2. In view of Applicants' amendment to the claims, the rejection of claims 1-12 under 35 U.S.C. 112 second paragraph, as stated in Paper No. 12, has been withdrawn.

Applicants' arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argued that Kaufman et al. (USPN 6063306, hereinafter "Kaufman") does not disclose the use of both BTA (or an anticorrosive) and a surfactant as a forming agent, and that in Kaufmann, the surfactant is used as a dispersion agent. The examiner disagrees, even though Kaufman does not spell out that the forming agent comprises a surfactant in addition to BTA, Kaufman's slurry is equivalent to the claimed slurry because both a surfactant and BTA are components of Kaufmann's slurry, the surfactant inherently also acts as a forming agent. Besides, BTA is an anticorrosive material (see the instant specification, page15, lines 12-19).

Applicants also argued that none of the applied references, Kaufmann, Sun et al. (USPN 6451697, hereinafter "Sun"), and Lee et al. (USPN 6303049, hereinafter "Lee") discloses that the metal to be polished is ionized and then made water soluble, as in the present invention. The examiner disagreed, Kaufmann discloses that the metal dissolves in the slurry (see col. 2, lines 53-65). Even though Kaufmann does not expressly state the mechanism of the dissolution, like in the present invention, in Kaufmann, the metal to be polished is inherently ionized and then made water soluble because of the presence of phosphoric acid and water in the slurry. In water phosphoric acid is in the ionic form (having hydrogen and phosphate ions), the presence of the hydrogen ions allows for the ionization of the Cu oxide resulted from the oxidation of the Cu metal. Ionized Cu is then dissolved in water in the same manner as the present invention. Therefore the combined teaching of Kaufmann with Sun or Sun and Lee does make obvious all the limitations of claims 1-21.

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Applicants are referred to the modified ground of rejection given below.

Claim Objections

3. Claims 1-5 are objected to because of the following informalities: in claim 1, line 3, before "with", insertion of --on the copper film--; in claims 9, 10, and 19, lines 24, 6, and 10, respectively, before "surfactant" or "polishing", insertion of --a--; in claims 13, 16, 19, and 20, lines 16, 20, 11, and 20, respectively, before "removing" or "polishing", insertion of --the--; in claims 13 and 20, lines 17 and 21, respectively, substitution of "comprising" or "comprised" with --comprises-- are suggested for clarity/ correctness. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. Claims 7 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 recites the limitation "thickener" in line 5 and claim 8, "said metal" in line 2. There is insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 103

4a. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was

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made in order for the examiner to consider the applicability of 35 U.S.C. 103[®] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-3, 9, 10, 13-15, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman in view of Sun .

[Claims 1-3] Kaufman discloses a polishing method by chemical mechanical polishing for a copper film formed on an insulating layer including via holes using a polishing liquid containing an oxidizing substance, a phosphoric acid, and a protection-layer forming agent and a surfactant; wherein said oxidizing substance contains hydrogen peroxide, and said phosphoric acid contains one selected from the group of orthophosphoric acid and phosphorous acid; and wherein said protection-layer forming agent contains benzotriazole (see col. 1, lines 53-67 and col. 4, line 53-col. 6, line 55). Hawley's dictionary is cited to show that in the normal use "phosphoric acid" means "orthophosphoric acid". It is inherent that the forming agent forms a protection-layer and the protection-layer is polished away on a convex portion of the copper film and the oxidizing substance oxidizes a surface of the convex portion of the copper film and renders an oxidized surface water soluble as a Cu ion by phosphoric acid. But it does not disclose expressly that the polishing slurry is substantially free from abrasive and that the surfactant is comprised in the forming agent. However, since the surfactant is a part of the Kaufmann's slurry, the resulting effect is the same, as when the surfactant is a part of the forming agent which is also mixed in the slurry, and the abrasive free limitation is well known in the art because Sun discloses this feature (See abstract). A person of ordinary skill is motivated to modify Kaufman with Sun to obtain scratch free planar surface.

[Claims 9, 10, 13-15, 19, and 20] An argument similar to the rejection of claims 1-3 applies. Kaufman also discloses a polishing method comprising (a) depositing a first metal film of a barrier metal on an insulating film having convex and concave portions, depositing a second metal film of copper on the first metal film (See abstract and col. 1, lines 40-65); (b) removing the second metal film on the convex portion and leaving the second metal film in the concave portion on the first metal by chemical mechanical using a polishing liquid containing an oxidizing substance, a phosphoric acid a surfactant, an abrasive and a protection-layer forming

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agent comprising an anticorrosive, (col. 4, line 53-col. 6, line 55), and (c) removing the first metal film on the convex portion and leaving the first metal in the concave portion by chemical mechanical polishing by a second polishing liquid obtained by adding an abrasive to said first polishing liquid (see col. 7, line 23-col. 9, line 23); and the second polishing liquid contains the protection-layer forming agent in a larger amount than said first polishing liquid (see col. 6, lines 37-42 and col. 8, lines 27-44). But it does not disclose expressly that the first polishing liquid is free of abrasive and the etching of the first metal film is by dry etching. However, the missing limitations are well known in the art because Sun discloses the etching with an abrasive free liquid, as shown above. The combined teaching of Kaufman and Sun does not teach the dry etching of the first metal film and the reducing atmosphere plasma cleaning exposed surface of metal for its adherence to a subsequently formed interconnect. However, the examiner takes Official Notice that these features are well known in the art. A person of ordinary skill is motivated to modify Kaufman with Sun to reduce dishing.

Therefore, it would have been obvious to combine Kaufman with Sun to obtain the invention as specified in claims 1-3, 9, 10, 13-15, 19, and 20.

6. Claims 4-8, 11, 12, 16-18, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman in view of Sun and Lee et al. (U.S. Patent 6303049, hereinafter "Lee").

[Claims 6 and 7] Kaufman discloses a polishing method for removing a copper film over an insulating film including via holes by chemical mechanical polishing, by using a polishing liquid containing an oxidizing substance, a phosphoric acid, benzotriazole (See abstract, col. 1, lines 40-65 and col. 4, line 53-col. 55), it is inherent that benzotriazole forms a protection-layer, the protection-layer is polished away on a convex portion of the copper film, the oxidizing substance oxidizes a surface of the convex portion of the copper film and the phosphoric acid renders an oxidized copper film water soluble. But it does not disclose expressly that the forming agent of the polishing liquid comprising an acrylic acid polymer and is substantially free of abrasives. However, the missing limitations are well known in the art because Sun discloses the use of abrasive free polishing liquid as shown above and Lee discloses the use of an acrylic

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acid polymer in the polishing liquid (See col. 3, lines 27-35) . A person of ordinary skill is motivated to modify Kaufman with Sun and Lee to reduce dishing (See Sun and Lee, abstract).

[Claims 4, 5, 8, 11, 12, 16-18, and 21] Arguments similar to the rejection of claims 6, 7 and of claims 9, 10, 13-15, 19, and 20 also apply. Kaufman also discloses a polishing method comprising (a) depositing a first metal film of a barrier metal on an insulating film having convex and concave portions, depositing a second metal film of copper on the first metal film (See abstract and col. 1, lines 40-65); (b) removing the second metal film on the convex portion and leaving the second metal film in the concave portion on the first metal by chemical mechanical using a polishing liquid containing an oxidizing substance, a phosphoric acid and a protection-layer forming agent (col. 4, line 53-col. 55), and (c) removing the first metal film on the convex portion and leaving the first metal in the concave portion by chemical mechanical polishing by a second polishing liquid obtained by adding an abrasive to said first polishing liquid (see col. 7, line 23-col. 9, line 23); and the second polishing liquid contains the protection-layer forming agent in a larger amount than said first polishing liquid (see col. 6, lines 37-42 and col. 8, lines 27-44). But it does not disclose expressly that the first polishing liquid is free of abrasive and that the forming agent of the polishing liquid contains a polymer selected from polyacrylic acid, polyammonium acrylate, polyamine acrylate, or bridged polymer thereof. However, the missing limitations are well known in the art as shown above.

Therefore, it would have been obvious to combine Kaufman with Sun and Lee to obtain the invention as specified in claims 4-8, 11, 12, 16-18, and 21.

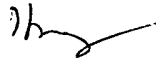
Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen

Primary Examiner

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